Final Draft Pre-Design Inspection Activities Work Plan
Libby Asbestos Project
Libby, Montana

June 2005
New A&E Contract Version

Prepared for:

EPA
Region 8

U.S. EPA Region VIII
999 18th Street
Suite 500, 8EPR-ER
Denver, Colorado 80202-2466

Prepared by:

U.S. Department of Transportation
Research and Special Programs Administration
John A. Volpe National Transportation Systems Center
Environmental Engineering Division, DTS-33
55 Broadway, Kendall Square
Cambridge, Massachusetts 02142

and:

CDM
One Cambridge Place
50 Hampshire Street
Cambridge, Massachusetts 02319

Final Draft
Pre-Design Inspection Activities Work Plan
for
Libby Asbestos Site
Libby, Montana

June 2005

New A&E Contract Version

Contract No. DTRS57-99-D-00017
Task Order No. C0025

Prepared for:

U.S. Environmental Protection Agency
Region VIII
999 18th Street, Suite 500
Denver, Colorado 80202-2466

Prepared by:

U.S. Department of Transportation
Research and Special Programs Administration
John A. Volpe Center National
Transportation Systems Center
Environmental Engineering Division, DTS -33
55 Broadway, Kendall Square
Cambridge, Massachusetts 02142

and

CDM

One Cambridge Place
50 Hampshire Street
Cambridge, Massachusetts 02139

Addendum to the June 2005 New A&E Contract Version

Final Draft
Pre-Design Inspection Activities Work Plan
for
Libby Asbestos Site
Libby, Montana

This document reflects Libby Asbestos Project roles, responsibilities, and relationships involving the previous A&E contract awarded to a single contractor. Under the new A&E contracts, Libby Asbestos Project roles, responsibilities, and relationships are not assigned to a single contractor, but are competed as separate task orders (TOs) (e.g., Design, Oversight, Community Relations, etc.) and may be performed by different contractors. Accordingly, offerors should refer to the TO to clarify issues in the GFI regarding roles, responsibilities, and relationships.

This document refers to Standard Operating Procedures (SOPs) from the previous A-E contract. These SOPs are confidential business information (CBI) of the previous A-E contractor; accordingly, the SOPs have been withdrawn from all GFI that contained them. The contractor shall utilize its own replacement SOPs having the same titles and numbers.

Where the GFI refers to the past contractor's quality assurance program, the contractor shall utilize its own quality assurance program.

Final Draft
Pre-Design Inspection Activities Work Plan
for
Libby Asbestos Site
Libby, Montana

June 2005

Contract No. DTRS57-99-D-00017
Task Order No. C0025

Prepared by:______________________________ Date:_______________
Eleonora Borisova
Project Engineer

Approved by:_____________________________ Date: ______________
Geoffrey McKenzie
Project Design Manager

Approved by:_____________________________ Date: ______________
George DeLullo
CDM Quality Assurance Manager

Approved by:_____________________________ Date:______________
John McGuiggin
Volpe Center Project Manager

Approved by:____________________________ Date: ______________
Jim Christiansen
EPA Remedial Project Manager

Contents

Appendices

Acronyms

ASTM	American Society for Testing and Materials
BD	building location identification
bgs	below ground surface
CDM	CDM Federal Programs Corporation
CIC	community involvement coordination
cm^2	square centimeter
CSS	contaminant screening study
DOT`	U.S. Department of Transportation
EIC	exterior inspection checklist
EPA	U.S. Environmental Protection Agency
FSDS	field sample data sheet
ft^2	square feet
HVAC	heating-ventilation-and-air-conditioning
IAG	inter-agency agreement
IFF	information field forms
LA	Libby amphibole
MCE	mixed cellulose ester
mm	millimeter
OSHA	Occupational Safety and Health Administration
PIWP	pre-design investigation work plan
PPE	personal protective equipment
RI	remedial investigation
RSPA	Research and Special Programs Administration
S/cm^2	structures per square centimeter
SIIC	supplemental interior inspection checklist
SOP	standard operating procedure
SUA	specific use areas
VCI	vermiculite-containing insulation
Volpe Center	John A. Volpe National Transportation Systems Center

Section 1
Introduction

The U.S. Environmental Protection Agency (EPA), Region VIII is conducting response actions at residential, commercial, and industrial properties located in Libby, Montana to address the risk to human health caused by exposure to Libby amphibole (LA) fibers. The LA fibers exist in multiple sources and media, such as contaminated soil, vermiculite-containing insulation (VCI), and contaminated interior dust, throughout Libby and the surrounding area. This pre-design inspection work plan (PDWP) outlines the approach to conducting interior and exterior inspections at properties identified for design of cleanup actions.

1.1 Inter-Agency Agreement

Through an inter-agency agreement (IAG), the U.S. Department of Transportation, Research and Special Programs Administration, John A. Volpe National Transportation Systems Center (Volpe Center) is providing environmental engineering and removal support to EPA Region VIII. Support activities include procuring cleanup and other contractors, preparing response action plans and designs, conducting response actions, providing response action construction management, and preparing technical studies and reports. Currently, the Volpe Center and its contractor, CDM Federal Programs Corporation (CDM), are providing support for the removal of LA asbestos contaminated materials in the forms of contaminated soil, VCI, and interior dust at residential and other properties located in Libby, Montana (herein referred to as the Libby Asbestos Project).

1.2 Document Purpose

Properties are selected for cleanup actions based on LA contamination present on the property. Contamination may be present in site soils, building insulation and materials, and/or interior dust. Pre-design inspections are performed at properties where cleanup actions are scheduled to take place. The purpose of this work plan is to describe the procedures for conducting pre-design inspections at residential and commercial properties around Libby. The inspections are performed to collect additional information on property characteristics and building construction for removal design planning. In addition, dust and/or soil samples may be collected to further characterize the property. This work plan serves as a guidance document for performing pre-design inspections and should be referenced during inspections as needed.

1.3 Background

The residential and commercial properties are located in and near the Town of Libby, Montana (Figure 1-1). The Town of Libby is located in northwestern Montana approximately 25 miles east of the Idaho border and 40 miles south of the Canadian border situated within the Kootenai River Valley, just north of the Cabinet Mountain

Range (Figure 1- 2). Libby is the site of the former largest vermiculite mine in the world, which had been operational for 70 years.

In the 1920s, the Zonolite Company formed and began mining vermiculite. In 1963, W.R. Grace bought the Zonolite mining operations. The mine closed in 1990. While in operation, the vermiculite mine in Libby may have produced up to 80 percent of the world's supply of vermiculite. Vermiculite has been used in building insulation and as a soil conditioner. It has been determined that the vermiculite from the Libby mine was contaminated with a very toxic form of naturally occurring asbestos, a solid solution series of asbestiform mineral fibers that includes tremolite, actinolite, winchite, and richterite. For convenience, this solid solution series is herein referred to as Libby Amphibole asbestos (LA).

Historical inspections at the Libby Asbestos Site include the Phase I and Phase II contaminant screening study (CSS) sampling programs and the ongoing remedial inspection (RI). The Phase I sampling program, initiated in early 2000, was designed as a rapid pilot-scale inspection to:

- Determine whether or not airborne asbestos levels in Libby required time-critical action to protect public health
- Obtain data on asbestos levels in potential source materials
- Identify the most appropriate analytical methods to screen and quantify asbestos in source materials

The Phase II sampling program began in March 2001 and was designed to refine human exposure and health risk estimates through collection of systematic data on asbestos levels in air and other media and identification of sources of airborne asbestos. A summary of the findings of the Phase I and II studies is presented below:

- Asbestos occurs in ore and processed vermiculite obtained from the mine site located outside the Town of Libby.
- Asbestos fibers of the type that occur in vermiculite ore from the mine site are hazardous to humans when inhaled.
- Asbestos material fibers that are characteristic of those that occur in materials from the Libby mine are present in a variety of different source materials at residential and commercial locations in and around the community of Libby. Outdoor source materials include yard soil, garden soil, driveway material, and assorted mine waste materials while indoor source materials include dust and Libby vermiculite attic insulation.
- Disturbance of asbestos-contaminated source materials can result in exposure to respirable asbestos fibers in air.

- The concentrations of fibers in air generated by disturbance of source materials may exceed Occupational Safety and Health Administration (OSHA) standards for acceptable occupational exposures, and estimated excess cancer risks can exceed EPA's typical risk range by an order of magnitude or more.

The CSS inspection, which was part of the RI activities for the Libby Asbestos Site Operable Unit 4, was initiated in early 2002 and employed a combination of visual inspections, verbal property owner interviews, and outdoor soil sampling to screen each property in the study area for the presence or absence of potential sources of LA in areas where exposure is most likely to occur.

The primary objective of the CSS was to determine the presence or absence of potential LA sources at each property within the study area. Additional objectives included:

- Identification of properties that require remediation, i.e., contain primary sources
- Identification of properties that require further inspection, i.e., contain or have indicators of secondary sources
- Quantification of relative LA abundance in soils
- Identification of characteristics of properties that may increase chances of exposure to LA
- Identification of characteristics of properties that may aid in development of remedial decisions
- Determination of spatial trends

Results of the Phase 1 and CSS inspections are used to determine which properties would require design inspection and subsequent cleanup activities. The selection process for identifying properties for cleanup activities is not the subject of this document.

The RI continued this year by conducting its second phase, which included visiting the properties listed above where additional information is required. Also, properties that were not visited during the CSS were investigated this year. Results from activities conducted this year were not available at the time of publishing this work plan.

1.4 Roles and Responsibilities

The following sections detail the roles and responsibilities for EPA, Volpe, and CDM for performing pre-removal design inspections.

1.4.1 EPA

EPA is the lead agency for the Libby project response action. It has overall responsibility for implementing the response action activities. It has put in place an IAG with the Volpe Center for managing the pre-design inspections and subsequent response activities at properties identified for the removal of contaminated soils, VCI, and interior dust. EPA responsibilities follow:

- Provide overall direction for the pre-design inspection activities
- Maintain the IAG with Volpe Center
- Provide funding to the Volpe Center in support of conducting pre-design inspections
- Approve of homes provided by CDM selected for pre-design inspections and subsequent cleanup actions
- Provide technical direction and design criteria requirements for response activities to ensure correct property details are collected at each removal property
- Approve all applicable field forms completed during pre-design inspections
- Approve and/or provide properties requiring immediate inspections and/or removal activity (i.e., fire, real estate transaction, utility construction/repair)

1.4.2 U.S. Department of Transportation (DOT)/Research and Special Programs Administration (RSPA)/Volpe Center

The Volpe Center will provide environmental engineering and remediation services and support to the EPA for pre-design inspections and response activities. Volpe Center responsibilities are as follows:

- Provide contracting for CDM for pre-design inspections
- Approve and monitor budget for conducting pre- design inspections
- Acquire project background data and regulatory information as needed
- Monitor progress of pre-design inspections and ensure EPA requests are met
- Provide onsite government representation at removal properties as necessary

1.4.3 CDM

CDM is the Volpe Center's design support contractor for the Libby Asbestos Project. As design contractor, CDM will:

- Develop work plans and all necessary field forms specific to conducting pre-design inspections

- Schedule properties for pre-design inspections and ensure all current analytical results are known
- Track progress of pre-design inspections to facilitate cleanup actions
- Provide personnel, equipment, and supplies to perform pre-design inspections
- Maintain residential file folders that include sample data, community involvement coordination (CIC) information, and copies of all applicable logbook pages, digital photographs, and EPA correspondence to support removal design planning
- Maintain communication with Volpe and EPA regarding progress of pre-design inspections as necessary
- Provide health and safety oversight and routine exposure monitoring for pre-design inspections as necessary

Section 2
Pre-Design Inspection Activities

Pre-design inspections are performed to capture additional information on a property for cleanup actions. The type of inspection is dependent on the contamination present on the property. For example, an interior inspection is performed on properties requiring bulk VCI removal while exterior inspections are performed on properties requiring soil excavation. Interior dust samples may be collected to determine if an interior cleaning is warranted.

The following is a summary of field activities that will be performed by CDM personnel during the pre-design inspections at Libby, Montana.

- Property selection
- Scheduling inspections
- Field documentation
- Exterior and interior inspections

2.1 Property Selection

Properties are grouped based on the type of LA asbestos contamination present on the property. The type and location of contamination determines what types of cleanup actions are required for remediation. Properties may be identified for interior removal only, exterior removal only, or both. Properties that are categorized as remediation complete, no cleanup actions required (i.e., no contamination present), or access denied (i.e., refusal) will not be scheduled for pre-design inspections. Interior cleanup actions include bulk VCI removal (based on visual observations) and/or interior cleaning (based on visual observation or dust sample results). Exterior cleanup actions include contaminated soil cleanup (based on visual observations and soil sample analytical results).

The detailed process for selecting properties for pre-design inspections is not discussed in this work plan. In general, property selection involves querying the Libby project database for properties with specific contamination (i.e., indoor, outdoor, both), reviewing previously collected data, and clustering homes geographically to maximize the efficiency of the cleanup/construction contractors.

2.2 Scheduling Inspections

Once a group of properties has been identified for cleanup actions, a pre-design inspection is scheduled for each property. Pre-design inspections are scheduled to identify a time convenient for the property owner to allow the inspection team to inspect the attic and/or collect interior dust samples. The property owner will be informed of the pre-design activities and the purpose of the inspection. On average, two to three inspections will be performed per day, depending on the complexity of the property and extent of contamination. This is based on a two-person field team. The property owner will generally not be advised of any estimated removal dates for their property during scheduling or the inspection process.

2.3 Field Documentation

Detailed notes will be recorded for each property investigated and all samples collected in accordance with CDM standard operating procedure (SOP) 4-1, Field Logbook Content and Control (CDM 2002). Photographic documentation will be recorded for each property in accordance with CDM SOP 4-2, Photographic Documentation of Field Activities. For each property inspected, the building location identification (BD) number, inspection form number and field sample data sheet (FSDS) number will be referenced in the applicable logbook. Field sample data sheets and inspection forms will be completed for each property. Inspection forms will consist of a supplemental interior inspection checklist (SIIC) and an exterior inspection checklist (EIC). An example of each inspection checklist is included in Attachment A.

Field logbooks will be maintained in accordance with SOP 4-1. The sample coordinator will manage the logbooks and will send original field logbooks, as they are completed, to the CDM office in Helena, Montana for document control. A copy of each logbook and inspection form will be maintained in the CDM office in Libby, Montana and Denver, Colorado.

2.4 Exterior and Interior Inspection

Weekly schedules of pre-design inspections will be given to the field team for planning purposes. The pre-design inspection team will consist of two CDM field team members. Exterior and interior inspections are discussed in detail in Section 3.

2.4.1 Health and Safety

All pre-design inspections will be conducted in accordance with the site comprehensive health and safety plan (CDM 2003). Interior inspections (not including attic entries) will be performed in modified level D personal protective equipment (PPE). All attic entries will be performed in modified level C PPE. Soil sampling activities will be performed in modified level D PPE. Negative exposure assessments for the pre-design inspection team will be performed as necessary or as directed by the site health and safety officer.

Section 3
Exterior and Interior Inspections

This section details the activities for performing exterior and interior pre-design inspection activities at properties identified for removal of contaminated soils, VCI, or both.

3.1 Exterior Inspections

Exterior inspections will be performed at properties where previous inspections indicate that contaminated soils exist either in yard or driveway areas or specific use areas (SUA). Specific use areas include

- Gardens
- Flowerbeds
- Play areas (sandboxes, swing set area, etc.)
- Stockpiles of fill material
- Planters

The purpose of the following sections is to detail procedures for conducting exterior inspections. The exterior inspections will be conducted by two CDM field team members and include the following activities:

- Review previously collected property data
- Perform site walkthrough
- Collect design soil samples, as required
- Complete EIC
- Collect dust samples, as required

3.1.1 Previously Collected Data

Prior to arriving at a property, the pre-design inspection team will review all previous data in order to become familiar with site conditions. Previous data may include Phase 1 inspections and/or sample results (soil, dust, air), CSS data (reconnaissance interviews and soil sampling results), or both. A complete set of property-specific sample data will be obtained from the Libby v2 database and maintained in the residential file folder. All property data (i.e., information field forms [IFF], FSDS, field logbook notes, etc.) will be reviewed to determine the general location of contaminated soils.

A Phase 1 inspection was not completed at every property in Libby. A Phase 1 inspection was only completed if a resident arranged to have the government inspect and/or sample suspect areas. Therefore, not all properties will have Phase 1 data. All properties selected for pre-design inspection and subsequent cleanup actions will have had a CSS inspection be performed. However, certain situations may arise that cleanup actions be performed at properties that have not undergone a complete CSS. In this case, the pre-design inspection team will complete a CSS inspection prior to completing the pre-design exterior inspection. If possible, the CSS inspection and the pre-design inspection will be completed during the same visit.

3.1.2 Site Walkthrough

Upon arrival to the site, the field team will notify the property owners to advise them of the inspection activities. Using the available data, the field team will walk the property to confirm known contaminated areas. In general, soil contamination will exist within:

- SUA
- Yard areas and driveways

3.1.2.1 Specific Use Areas

The field team will first identify SUA where vermiculite was reportedly observed. Visible vermiculite within SUA requires soil removal without further sampling as directed by EPA. The horizontal boundaries of vermiculite within the SUA will be identified and indicated on site sketches and the EIC (Section 3.1.3). It is not necessary to determine the vertical extent of contamination as the default excavation depth for the SUA is 18 inches below ground surface (bgs). All contaminated SUA will be measured so that an estimated volume of soil to be removed can be calculated.

3.1.2.2 Yard Areas and Driveways

Analytical results from soil samples collected during the CSS from the yard areas and driveways will be used to identify contaminated areas. That is, visible vermiculite within yard areas and driveways will generally not be used as an indicator for excavation activities. Rather, analytical results from soil samples collected from within these areas will be used to determine if excavation is necessary. Soil areas with sample results greater than nondetect (LA asbestos) will be considered contaminated and will require excavation. However, if vermiculite is found within yard areas and driveways in the form of tailings (i.e., fine, sandy texture, unexfoliated vermiculite), these areas will be identified as requiring excavation. The pre-design inspection team will use professional judgment to determine how much vermiculite within a yard constitutes further soil sampling or excavation. Once the contaminated yard and driveway areas have been identified, the design team will determine if design soil sampling is necessary.

3.1.3 Exterior Inspection Checklist

An EIC will be completed for each property requiring an exterior inspection. The purpose of the EIC is to capture property detail and to supplement the site-specific work plans or design plans. Work plans and design plans are developed for each property requiring cleanup actions. These plans detail where known contamination exists and provides specific protocol for removal and restoration activities. A copy of the EIC is included as Attachment A. The following sections explain in detail what information and site detail will be captured on the EIC.

The EIC is designed to capture the overall exterior characteristics of the property. Locations of SUAs containing visible vermiculite will be indicated on previous inspection field forms (e.g., IFF) and/or logbook notes. These areas, along with contaminated soil areas (per analytical results), will be verified by the inspection team and indicated on a detailed property sketch. The following sections summarize the detail that will be captured on the EIC:

- Vegetation
- Secondary structures
- Driveways and sidewalks
- Utilities
- Miscellaneous information

3.1.3.1 Vegetation

Vegetation that exists within contaminated areas such as grass, trees, and ornamental plants and shrubs will be summarized in the EIC although taxonomic classification (i.e., genus species) for each plant is not necessary. This detail will be captured under the respective heading (Flowerbed, Garden) on the EIC and provide a brief description of flowers, bushes, etc. present. General detail of the vegetation (e.g., various perennials, bulbs, tomato plans, etc.) will be used to determine the extent of restoration to be performed after cleanup actions are complete. A restoration contractor will be tasked with identifying vegetation within contaminated areas that will be removed during soil excavation.

3.1.3.2 Secondary Structures

Secondary structures (e.g., detached garage, shed, outbuildings) are to be identified and indicated on site sketches if they exist on contaminated soils. It will also be noted if the secondary structure(s) may cause interference with the removal of contaminated soils (e.g., setup, excavation, etc.). The field team will inspect the foundation of secondary structures (located within contaminated areas) to try and determine if contamination extends beneath the foundation. This inspection will be performed by visual observation (i.e., no samples will be collected).

3.1.3.3 Driveways and Sidewalks

Driveway and sidewalk detail will be captured on the EIC. The type of driveway and sidewalk will be identified for each property for removal activity setup purposes. Driveway and sidewalk features such as length, width, and borders only need to be captured if soil sample results indicate that the driveway or sidewalks need to be removed.

3.1.3.4 Utilities

The inspection team will note the location of utilities (e.g., water, electric, telephone, etc.) on the site-specific property sketches. This will be performed by visual inspection and/or asking the property owners for known locations. The location of utilities is for information purposes only and does not satisfy utility locate requirements for the State of Montana. This will be the responsibility of the cleanup/construction contractor.

3.1.3.5 Miscellaneous Information

Any additional pertinent information not mentioned in the previous sections will also be captured on the EIC. This information will be used to plan setup and identify any problems that may arise during cleanup actions. In addition, volume calculations for the amount of soil to be removed will be shown on the EIC.

3.1.4 Dust Sampling

Interior dust samples will be collected at properties that have contaminated soils or visual vermiculite in SUA. Dust sampling procedures are described in Appendix B.

3.1.5 Soil Sampling

Design soil samples are collected to more accurately delineate the extent of contamination and to establish excavation (cut) lines. Previous soil sampling efforts (Phase 1 and CSS) employed composite sampling techniques that encompassed areas as large as 5,500 square feet (ft^2). The objective of design soil sampling is to collect additional surface (0 to 1 inch) soil samples (composite or grab) within contaminated areas to delineate the required area of excavation.

The soil sampling process, as discussed in the RI SAP (CDM, 2002), will involve the following steps:

- Determine the location of design soil samples.
- Collect samples.
- Complete the sample field forms.
- Decontaminate all non-disposable sampling equipment.

3.1.5.1 Sample Locations and Rational

Professional judgment will be used to determine the exact location of design soil samples but the following guidelines will be used to maintain consistency. In general, a design sample will consist of a five-point composite (five subsamples submitted as one sample) surface soil sample covering an area where contaminated soil has been identified. The soil samples will be strategically collected to identify the clean soil/contaminated soil interface. A five-point composite sample will not cover more than approximately 250 ft^2.

3.1.5.2 Sample Collection

All design soil samples will be collected in accordance with SOP CDM-LIBBY-05 Revision 1, Site-Specific SOP for Soil Sample Collection (CDM, 2002).

3.1.5.3 Field Form Completion and Property –specific Sketch

For each sample collected, a field sample data sheet for soil will be completed in accordance with SOP CDM-LIBBY-03, Completion of Field Sample Data Sheets. The sample identification number associated with the sample point will be in the form of DI-#####. The field team will indicate on the property-specific sketches where the design samples were collected. Upon receipt of analytical results, the sketch will be completed to show the horizontal limits of excavation. It is not necessary to determine the vertical extent of contamination, as the maximum default excavation depth for yard areas and driveways is 12 inches bgs.

3.1.5.4 Decontamination

All decontamination will be conducted in accordance with the RI SAP (CDM 2002). All non-disposal sampling equipment will be decontaminated between sample locations but will not be decontaminated between subsample locations.

3.2 Interior Inspections

Interior inspections will be performed at properties where previous inspections indicate that structures (i.e., homes, garages, outbuildings) are insulated with VCI and/or dust sample results (if previously collected) indicate the structure is contaminated with interior dust containing LA asbestos.

The purpose of the following sections is to detail procedures for conducting interior inspections. The interior inspections will be conducted by two CDM field team members and will include the following activities:

- Review previously collected data
- Perform site walkthrough and complete SIIC
- Collect interior dust samples, as required

3.2.1 Previously Collected Data

Prior to arriving to a property, the pre-design inspection team will review all previously collected data in order to become familiar with site conditions. Previous data may include Phase 1 inspections and/or interior dust sample results, CSS data (reconnaissance interviews), or both. A complete set of property-specific data will be obtained from the Libby v2 database and maintained in the residential file folder. All property data (i.e., IFF, FSDS, field logbook notes, etc.) will be reviewed to determine the general location of VCI within the attic areas.

Not all properties have had a Phase 1 inspection performed. All properties selected for cleanup actions will require that a CSS inspection was performed. However, certain situations may arise that cleanup actions be performed at properties that have not undergone a complete CSS. In this case, the pre-design inspection team will complete a CSS inspection prior to completing the pre-design interior inspection. If possible, the CSS inspection and the pre-design inspection will be completed during the same visit.

3.2.2 Supplemental Interior Inspection Checklist

A site walkthrough and SIIC will be completed for each property requiring an interior inspection. The purpose of the SIIC is to capture building construction detail and to supplement the site-specific work plan or design plans. A copy of the SIIC is included as Attachment A. The following sections explain in detail what will be captured on the SIIC.

3.2.2.1 General Description

This section primarily documents the number and type of attics and attic access issues and will include both interior and exterior considerations. For general purposes, the pitch of a roof can be determined by the width of the house and the height inside the attic. The flatter the slope of the roof, the more difficult it is to remove VCI in the outer edges of the attic space.

Type of Attics

In general, attics are finished, unfinished, or a combination of both. The attics can have isolated sections, different construction due to past remodeling, and multiple layers of flooring or ceilings. Older homes with multiple attic sections and ceilings have been encountered, and it is important that a good effort be given to compare the exterior roof lines with the interior areas to determine if isolated attic areas exist. The barriers between attic spaces will be described, and it will be determined if separate accesses exist or if one needs to be made. Additional attic floors/ceilings will be documented in terms of the dimension of the floor joist size and spacing, flooring type, height between the floors, and presence of VCI.

Interior Access

The concern for this section is to document the physical work required to set up attic access inside the buildings. Two possible access scenarios can occur and are dependent on interior dust sampling results:

- If the dust samples contain LA, the interior will be cleaned and the containment setup will be on the exterior of the building. This is the simplest condition.

- No dust sampling results are available or the interior is determined to be clean. The effort to access the attic is increased with the requirement to build a containment tunnel into the building to the access point of the attic. In both scenarios, the attic entry information is important but in the second, the interior access or pathways will be documented from the exterior entrances to the attic entries. This will enable the abatement contractor to determine the tunnel building effort.

Exterior Access

If interior cleaning is not required, it is preferable to gain access to the attic space directly from the outside through existing openings. The inspection team will consider the bulleted items below and document them at the end of the SIIC under *Additional Information*:

- Document the possible areas in regards to equipment staging and setup access and consider what existing improvements might need to be repaired or replaced.

- The proximity of the access points to the electrical service or weatherhead will be included on the site drawing.

- Attic vents may be considered 'criticals' as part of the containment, so it is beneficial to document the size, number, and approximate spacing.

3.2.2.2 Finished Attics

Finished attics are typically easier to work in for both the pre-design inspection teams and the removal contractors, but they can have VCI under floors, in side storage areas (behind kneewalls), and in false or drop ceilings.

Kneewalls

Very often in finished attics, the narrowing of the room where the pitch of the roofline meets the walls is isolated to give a more finished look to the area and to have an area for attic storage. These areas will be investigated because they may have a continuation of the finished flooring or may be unfinished. The inspection helps to determine the construction of the ceiling/floor joists, the extent of the VCI, and may give access to inspect what is under the floor in the finished area. Finally, it will be noted if there is access to the space between the interior ceiling and the finished attic floor for inspection and/or cleaning of VCI.

Attic Floor Construction
The framework of the attic floor typically is the top of the ceiling joists of the room below the attic space. If remodeling has been done, this room below the attic (i.e., bedroom, living room, etc) may have a lowered or "drop" ceiling without any evidence in the attic. This condition is best observed at the interior attic entrance or by observing if any variance exists in interior ceiling heights.

The weight bearing capacity of the attic floor system, determined by the spacing and size of the attic floor joists, is important to document to prevent damage during cleanup actions. The damage can occur if the system cannot support the weight of the removal crew working within the attic space.

3.2.2.3 Unfinished Attics

Unfinished attics require the same basic inspection procedures as finished attics in regards to identifying isolated sections, entries, possible multiple floors/ceilings, and construction. Many times unfinished attics have been left unfinished due to existing truss or bracing that restricts movement in the area. If this condition is present, a brief description will be included for planning the work in this space.

3.2.2.4 General Condition of Attic

This section of the SIIC is to document the overall structural condition of the roof/attic area. Here is where the inspector will describe the age and overall condition of the system and document any specific observable damage. This information is useful to document the ability of the system to support the workers and equipment during the removal process.

3.2.2.5 Living Space Assessment

This section provides the information for the living space, which includes the configuration of the rooms (bedrooms, living rooms, etc), condition of the interior ceilings, and documentation of possible pathways for interior VCI exposure such as ceiling light fixtures or electrical receptacles where VCI could "leak" out into the living space.

Description of Rooms
The accounting of the number and type of interior rooms and if the rooms are furnished is documented in this section. The information in this section is important in the work planning process and is used to estimate time and effort to perform interior cleanings. Special concerns such as large indoor plants, grand pianos, and aquariums that can affect movement or require special handling will be noted.

Ceiling Condition
Documenting the pre-removal condition of the interior ceilings is important to observe and describe evidence of VCI leaking into the living space, the presence of cracking and/or sagging, and any out of the ordinary ceiling material. The areas where ceiling related VCI leaks can occur include closets, kitchen cabinets, and light

fixtures. Additional locations to inspect for VCI leaks are listed in the *Pathways* section below. The importance of the presence of ceiling damage relates back to the issue of whether the attic framing can support work crews. It will be noted if decorative, T-bar, or fragile tile are used as ceiling materials for work planning and possibly restoration effort and cost.

Pathways

The presence of VCI in living spaces often is due to openings between the attic and the living space. The common types include ceiling light fixtures and cabinets described above but also include wall switches and plugs, plumbing vents, heating-ventilation-and-air-conditioning (HVAC) registers, and the air space around chimneys. The process to investigate these locations requires professional judgment and includes removing visual barriers. The electrical switch and plug inspections will be in areas where the VCI is most likely to be found like exterior walls but not under windows where there is no direct pathway from the attic. The number of electric plates inspected will give a representative sample of the house and will include a few interior walls. The procedure to inspect HVAC registers is similar to the electrical plates and requires a representative sample be opened. VCI leaks around plumbing vents and chimneys are usually seen in the crawl space or basement of the building where the VCI has sifted through the walls into these areas.

3.2.2.6 Electrical

The electrical portion of the inspection will document the location of the various components of the electrical system, assess the condition of the components and potential of removal work causing damage to the system, and the method of turning off the service.
The electrical components that need to be located include the service connection from the electric provider, the main service breaker panel, electric circuits or wiring within the work areas, and junction/switch boxes within the work areas.

The condition and type of materials of the system help in the development of work procedures. The potential of damage to electrical equipment is high in attics because it is typically hidden under the insulation being removed. Cleanup work is often a process of crawling in restricted spaces, and the potential for workers damaging exposed conduits as they move equipment and perform the cleanup work is high. Older homes may have circuits that are easily damaged by any form of handling. Past crews have observed cloth-covered wires and even bare post and wire systems in attics. Any unprotected wire splices or uncovered junction boxes observed in the work area will also be noted both as documentation of existing conditions but also to allow the contractor to protect them.

Due to the possible damage to the electrical system within the work area, the electrical service is normally turned off at the main service panel. It will be documented if a main breaker is not present and/or the power provider is required to turn off the service to the building. The only situation where building power is left on is where the removal work is limited to interior cleanings only with no attic VCI removal.

The electrical power requirement for the removal work is supplied by the contractor by means of portable generators. The electric equipment, air moving equipment, lighting, and tools are powered by the generator.

3.2.2.7 Mechanical Systems

The reporting procedure for mechanical system in a building is similar to what is expected in the electrical inspection in terms of the need to document the location of the various components of the system, assessment of the condition of the components and potential of the cleanup work causing damage to the system and finally, the method of turning off the power or fuel to the service.

The term mechanical system refers to the equipment, material, and controls used to monitor and control the air in a building. The systems normally include the HVAC. These systems can have separate mechanical units that perform each type of air treatment or all three can be combined in one unit. Electricity is used to operate the air circulation fans, compressors in air conditioning units, and heating coils in electric heating systems. Other fuels used in heating systems include wood products, oil, or propane. The two types of heating systems normally found in Libby are radiant and forced air. Radiant systems circulate heated water through pipes then into the living space through open-air registers or embedded pipes in floors. In the forced air systems, the treated air is piped to and from the mechanical equipment in air ducts and then into the living space through registers. The air ducts can be located throughout the building, including attic, basements, and walls.

The exhaust pipes or flues of mechanical systems require inspection. Specifically, the air gap between the heat exhaust pipe and the building framing is a common conduit for VCI leaking from the attic area and needs to be investigated. Fireplaces and stoves have the same air gap and will be considered part of a building's mechanical system. The SIIC form lists the pertinent information of the mechanical systems. This information includes the location of the equipment, type of system, if portions of the system are present in the attic space or if they will interfere with removals, and methods of shutdown or turning off power or fuel. Observations will include the inspection of the interior of the ductwork for VCI, if present.

3.2.2.8 Plumbing Systems

The plumbing system, like the electrical and mechanical systems are found throughout buildings. An inspection will document any plumbing that possibly interferes with access for the removal of VCI. The main issues are the location of the water heater, type of heater, and if the building is on city water or a well. The water source is important because if the building is on a well, the removal contractor will be required to provide his/her own water supply. It is also beneficial if the control valves and drains are noted in radiant heating systems for winter operations.

3.2.2.9 Understructure

The understructure of a building refers to any area under the structure or footprint of the building. This definition may include a porch if access under the porch is from inside the building. Note: if the area under a porch is open or accessed from outside the building, the inspection would be documented in the exterior inspection checklist or EIC. Types of understructures found in buildings can be dirt floor 18-inch high crawl space, full height partial basement with only enough space for the mechanical equipment, full height finished basements, or some combination of all of these. As with the attic inspections, the inspection team will look at the footprint of the house and compare it to what is observed in the understructure to ensure all accessible areas are inspected.

The information will describe the type of structure, flooring, and all entries. If the understructure is used for storage, the type and volume of the materials will be documented especially if the area is slated to be cleaned. Another issue that may occur in buildings being inspected is the presence of asbestos-containing materials (ACM) pipe insulation and plant potting materials with visible vermiculite. These materials can interfere with air sampling and will be documented.

3.2.2.10 Location and Quantity of VCI

Documenting the location and quantity of VCI and non-vermiculite insulation (e.g., fiberglass, cellulose, etc) in the building involves estimating areas and depths of the materials. The quantity of non-vermiculite insulation is only important when this material is in contact or close proximity (shares the same air space) with VCI and will also be removed during the removal process. This volume is used to calculate the removal and restoration quantities and methods the removal contractors will use. This section of the SIIC is a summary of the important VCI removal information and will be filled out during the entire inspection process.

The question of the VCI in other building materials is a reminder to document if VCI is present in areas such as ceiling materials, mortar, indoor plant soil, etc.

3.2.3 Dust Sampling and Results

Dust samples will be collected in the living space if the home is insulated with VCI or exterior contamination exists on the property and if they were not collected during previous inspections. The pre-design inspection teams will collect dust samples during the inspection process. The dust sample results will be used to determine if an interior cleaning is required at the property. The procedures used for dust sampling are detailed in Appendix B.

If dust samples were taken at a property in the past, these samples will be evaluated to determine if they meet the existing protocol. If the samples meet the current protocol, an additional sample will not be collected from that area. If VCI is visible in the living space, no dust samples will be collected.

The following protocol will be applied when collecting dust samples in buildings during pre-design activities. Dust sampling results will be used as a screening tool to identify buildings that exceed the LA asbestos remedial action level of 5,000 S/cm^2.

3.3 Vermiculate Containing Building Material

If building materials are suspected to contain vermiculite, a determination will first be made as to whether the material is friable. If the material is not friable, no further action will be taken and the material will be left in place. If the material is friable, it will be sampled in general compliance with 40 CFR 763.86 (Appendix C- AHERA Sampling Requirements) and analyzed in accordance with RI SAP (CDM 2002)

Section 4
References

CDM. 2003. Comprehensive Site Health and Safety Program for the Initial Emergency Response Action, Libby, Montana, Revision 3. May.

____. 2002. Final Sampling and Analysis Plan Remedial Inspection, Libby, Montana. April.

____. 2003. Design Analysis Report, Libby, Montana. May.

Appendix A

Inspection Checklist (Interior and Exterior)

[Code of Federal Regulations]
[Title 40, Volume 29]
[Revised as of July 1, 2004]
From the U.S. Government Printing Office via GPO Access
[CITE: 40CFR763.86]

[Page 739-740]

TITLE 40--PROTECTION OF ENVIRONMENT

CHAPTER I--ENVIRONMENTAL PROTECTION AGENCY (CONTINUED)

PART 763_ASBESTOS--Table of Contents

Subpart E_Asbestos-Containing Materials in Schools

Sec. 763.86 Sampling.

(a) Surfacing material. An accredited inspector shall collect, in a statistically random manner that is representative of the homogeneous area, bulk samples from each homogeneous area of friable surfacing material that is not assumed to be ACM, and shall collect the samples as follows:

(1) At least three bulk samples shall be collected from each homogeneous area that is 1,000 ft\2\ or less, except as provided in Sec. 763.87(c)(2).

(2) At least five bulk samples shall be collected from each homogeneous area that is greater than 1,000 ft\2\ but less than or equal to 5,000 ft\2\, except as provided in Sec. 763.87(c)(2).

(3) At least seven bulk samples shall be collected from each homogeneous area that is greater than 5,000 ft\2\, except as provided in Sec. 763.87(c)(2).

(b) Thermal system insulation. (1) Except as provided in paragraphs (b) (2) through (4) of this section and Sec. 763.87(c), an accredited inspector shall collect, in a randomly distributed manner, at least three bulk samples from each homogeneous area of thermal system insulation that is not assumed to be ACM.

(2) Collect at least one bulk sample from each homogeneous area of patched thermal system insulation that is not assumed to be ACM if the patched section is less than 6 linear or square feet.

(3) In a manner sufficient to determine whether the material is ACM or not ACM, collect bulk samples from each insulated mechanical system that

[[Page 740]]

is not assumed to be ACM where cement or plaster is used on fittings such as tees, elbows, or valves, except as provided under Sec. 763.87(c)(2).

(4) Bulk samples are not required to be collected from any homogeneous area where the accredited inspector has determined that the thermal system insulation is fiberglass, foam glass, rubber, or other non-ACBM.

(c) Miscellaneous material. In a manner sufficient to determine whether material is ACM or not ACM, an accredited inspector shall collect bulk samples from each homogeneous area of friable miscellaneous material that is not assumed to be ACM.

(d) Nonfriable suspected ACBM. If any homogeneous area of nonfriable suspected ACBM is not assumed to be ACM, then an accredited inspector shall collect, in a manner sufficient to determine whether the material is ACM or not ACM, bulk samples from the homogeneous area of nonfriable suspected ACBM that is not assumed to be ACM.

LIBBY ASBESTOS PROJECT
Exterior Inspection Checklist (EIC)

Field Logbook No.: ______________ Page No.: ________ Site Visit Date: ________________

Address: ____

Occupant: ____ Phone Number: __________

Owner (If different than occupant): _________________________ Phone Number: __________

Investigation Team: ____

Field Form Check Completed by (100% of forms): ___________________________________

If an interior inspection is not required, collect interior dust samples as necessary

Data Item	Value	Comments
GENERAL INFORMATION		
Any detectable levels of LA on property?	Yes No	Location:
Visible vermiculite on property?	Yes No	Location:
YARD AREAS		
Will any yard area require removal? *Circle all that apply*	*Rationale* Yes - Gross Yes - Analytical No - Vermiculite visible No - No vermiculite present NA	*Location (note high traffic areas)*
Vegetation on lawn *contaminated area only*	Grass Gravel mix Other ___________ None	

Data Item	Value	Comments
	NA	
Trees within contaminated area **greater than** 6 inches?	Yes No	Type and number: *Note location and drip line diameters on sketch*
Trees within contaminated area **less than** 6 inches?	Yes No	Type and number: *Note location on sketch*
Shrubs within contaminated area?	Yes No	Type, number, and size:: *Note location on sketch*
Secondary structures on property within contaminated area? *Collect dust samples as necessary*	*Structure* *Count* Shed ______ Deck _______ Carport ______ Other_____________	*Discuss foundation and mobility.* *Collect exterior and interior photographs*
Evidence of contamination beneath secondary structures?	Yes - Gross, no sample Yes - Minimal, collect samplel No NA	*Note distance between soil surface and bottom of secondary structure:* *Collect soil samples as necessary*
Household/yard items located on contaminated	Yes No NA	*Explain contents/mobility and note approximate location(s) on sketch:*

1.
2.

Data Item	Value	Comments
area?		
Fence present within contaminated area?	Yes No Partial	*Type(s), condition, and height:* *Illustrate on sketch.*
<u>FLOWERBED</u>		
3. Are there any flowerbeds present that have visible vermiculite in soil?	Yes - _________ No NA	*Illustrate on sketch.*
Flowerbed contain flowers or plants?	Yes No NA	*Brief description of type(s):*
Decorative items (bird baths, trellis, etc.) in flowerbed?	Yes No NA	*Brief description (type, size, mobility):*
Does flowerbed have borders/fence?	Yes No NA	*Type, size, and material*(s):
<u>GARDEN</u>		
4. Are there any gardens present that have visible vermiculite in soil?	Yes - _________ No NA	*Illustrate on sketch.* *Note former versus current*
Garden contain crops?	Yes No	*Brief description:*

Data Item	Value	Comments
	NA	
Decorative items (bird baths, trellis, etc.) in garden?	Yes No NA	*Brief description (type, size, mobility):*
Does garden have borders/fence?	Yes No NA	*Type, size, and material*(s):
<u>DRIVEWAY</u>		
Type of driveway	Concrete Gravel Asphalt Soil None Other___________	*Note location on skecth*
Will driveway require removal? *Only applies to gravel or soil driveways.*	Yes - Gross vermiculite Yes - Analytical results No - Vermiculite present No - No vermiculite present NA	
5.		
Evidence of vermiculite under driveway? *Only applies to concrete or asphalt driveways.*	Yes - Encapsulated Yes - Exposed No NA	
6.		
Complete following only if driveway is to be removed.		
Approximate length	Feet ________	
Approximate width	Feet ________	

Data Item	Value	Comments
Approximate depth	Inches _______	
Any driveway borders?	Railroad ties Brick Drain/Gutter Other_________________ Pressure-treated wood Flowerbed	
SIDEWALKS		
Type of sidewalk	Concrete Gravel Asphalt Flagstone None Other____________	*Note condition and mobility of material if necessary*
7. Evidence of vermiculite under sidewalk? *Only applies to concrete or asphalt sidewalks.*	Yes - Encapsulated Yes - Exposed No NA	
Complete following only if vermiculite is exposed in sidewalk.		
Approximate length	Feet ________	
Approximate width	Feet ________	
Approximate depth	Inches _______	
Any sidewalk borders?	Railroad ties Brick Drain/Gutter Other_________________ Flowerbed	
UTILITIES *Note: Removal contractor must schedule a utility clearance meeting prior to excavation.*		
Water supply	Well City Water Other____________	
Underground utilities	Water Wastewater Septic system Electrical	

Data Item	Value	Comments
	Phone Sprinkler systems	
Aboveground utilities	Electrical Phone Television cable/dish	
Heating oil tank	Yes No	
Other utilities not listed		
Note special excavation concerns in regards to utilities:		
<u>OTHER</u>		
Visible vermiculite in flower pots/hanging baskets?	Yes No NA	*Note number and size of flowerpots and general location:*
Is property used for commercial purposes?	Yes No	
Does owner have outdoor pets?	Yes No	
Evidence of contaminated fill material on property?	Yes No	*Illustrate locations and dimensions on sketch* *Check understructures if SIIC is not completed and collect samples as necessary.*
Does home owner suspect vermiculite contamination at other areas on property?	Yes No	*Location and history:* *Collect samples and note on sketch*

Data Item	Value	Comments
		as necessary
PROPERTY SURVEY		
Will property require land survey?	Yes - Excavation required along property boundary and /or consists of yard area - *Detail property sketch not needed* No - *Property sketch needed* Explain:____ ____ ____	
DESIGN SAMPLING		
Design sampling necessary?	Yes - Number of samples collected to establish cut lines ______ *Do not finish cut line sketch until sample results are known* No - Cut lines delineated Explain:____ ____ ____ ____ ____ ____ Other____	

8.

PHOTO LOG

____
____
____
____
____
____

ADDITIONAL INFORMATION

LIBBY ASBESTOS PROJECT
Supplemental Interior Inspection Checklist (SIIC)

Field Logbook No.: ______________ Page No.: ________ Site Visit Date: ______________

Address: ________________________________ Structure Description: ______________

Occupant: ____ Phone Number: ________

Owner (If different than occupant): ________________________ Phone Number: ________

Investigation Team: ____

SIIC Check Completed by (100% of forms): __________________________________

Data Item	Value	Comments
<u>GENERAL</u> <u>DESCRIPTION</u>		
1. Type of attic	Finished Unfinished	
Attic ceilings	Attics within attics None Other __________	
Location of attic entries	Outside Inside None	*Sketch location(s) on attached map*
Number of attic entries	1 2 3 Other:______	
Type of entry	Door Removable panel Stairs Other: __________	*Collect photos of each*
Size of each attic entry *specify units*	1: _______________ 2: _______________ 3: _______________ Other: ______	*Add additional information at end of SIIC*
Attic vents	Number of vents:_____	*Briefly describe and sketch on attached map*
Eave vents present?	Yes No NA	*Briefly describe and sketch on attached map*

Data Item	Value	Comments
FINISHED ATTICS		
Kneewalls present?	Yes No NA	*Sketch location(s) on attached map*
Kneewall Construction	Open Studs Finished Carpentry	
Can all areas behind kneewalls be accessed?	Yes No NA	
Number of access to areas behind kneewalls	Number: ________ Type: __________	
Attic floor joist size	_____ in x _____ in	
Attic floor joist spacing	______ in	
Flooring in finished attic	Tongue and groove Plywood Carpet Linoleum None (open joists) Other: _____________	Entire area or partial area *Illustrate on Section Detail*
Flooring behind kneewalls	Tongue and groove Plywood Carpet Linoleum None (open joists) Other:______________	Entire area or partial area *Illustrate on Section Detail*
Is finished attic furnished?	Yes No NA	Brief description: *Document with photos*
Items stored in area behind kneewalls:	Yes No NA	Brief description:
Are kneewalls cluttered?	Yes No NA	*Document with photos*

Data Item	Value	Comments
Kneewall areas easy to access? **(i.e., headspace, width, etc.)**	Yes No NA	Brief description:
Items in contact with VCI?	Yes No NA	Brief description:
Ceiling material in finished area	Plaster/Lathe Sheetrock Other:_______________	*Illustrate on Section Detail*
Ceiling construction in finished area	Drop Ceiling Cathedral Other:_______________	*Illustrate on Section Detail*
General condition of ceiling	Good Poor NA	
Kneewall material	Plaster/Lathe Sheetrock Wood Paneling Other:_______________	*Illustrate on Section Detail*
Wall finish	Paint Wall paper Plywood Other:_______________	*Illustrate on Section Detail*
General condition of walls	Good Poor	
UNFINISHED ATTIC		
Can all areas in attic be accessed?	Yes No NA	
Are any areas in attic segregated into individual rooms?	Yes No NA	Brief description:

Data Item	Value	Comments
Number, size, and type of entries between rooms if applicable	*Provide details on sketch, collect photos as necessary*	
Attic floor joist size	_____ in x _____ in	
Attic floor joist spacing	______ in	
Flooring in attic above joists	Tongue and groove Plywood None (open joists) Other:_____________	Entire area or partial area *Illustrate on Section Detail*
Flooring in attic below joists	Brief description: *Illustrate on Section Detail*	
Items stored in attic?	Yes No NA	Brief description:
Items in contact with VCI?	Yes No NA	Brief description:
<u>GENERAL CONDITION OF ATTIC</u>		
Evidence of physical damage	Yes No	*Sketch location(s) on attached map and document with photos*
Evidence of water damage	Yes No	*Sketch location(s) on attached map and document with photos*
Structural condition of roof	Good Poor	*Document with photos*
Structural condition of roof rafters	Good Poor	*Document with photos*
Structural condition of floor joists	Good Poor	*Document with photos*
Structural condition of	Good Poor NA	

Data Item	Value	Comments
chimney		*Document with photos*
Any other structural concerns?	*Illustrate on sketch and collect photos as necessary*	
LIVING SPACE ASSESSMENT		
Describe: Number/type of rooms in building Furnished/Unfurnished Special concerns	*Illustrate on sketch and collect photos as necessary (Special Concerns)*	
Ceiling cracks as viewed from living space?	Yes No	*Sketch location(s)/dimension(s) on attached map and document with photos*
Utility conduits in attic leading to living space and/or understructure?	Yes No Type: Electrical HVAC Plumbing Other: __________	*Sketch location(s) on attached map and note gaps if present:* *Document with photos if potential for VCI leakage*
If yes, VCI observed around conduits?	No Living space Understructure Other______________	Location: *Document with photos if potential for VCI leakage*
ELECTRICAL SYSTEM		
Electrical wire in attic	Yes No	
Type of electrical wiring	Bare (with insulators) <u>Insulation type:</u> Cloth/Ceramic Plastic Both	

Data Item	Value	Comments
Electrical Outlets/Switches in attic	Yes No	Working condition:
Electrical shutoff system	Breaker box Fuse box Other: ___________	Location:
MECHANICAL SYSTEMS		
Plumbing in attic	Yes No	
HVAC in attic	Yes No	
Heating system	Fuel oil Electric Propane Wood stove Other: ____________	
Heating type	Forced air Radiant heat	
Methods to shut down heating system	Yes No	Describe:
PLUMBING SYSTEMS		
Water source	City Well Other: ___________	Contractor able to use water for removal activity?
Type of water heater	Electric Propane Other: ___________	
UNDERSTRUCTURE		
Type of understructure	Finished Basement Unfinished Basement Crawlspace None	*Collect soil/dust samples as needed* *If VCI present in understructure, document contamination on second sketch and with photos, as necessary*
Type of flooring	Concrete Structural/Wood Soil Other_______________	*Illustrate on Section Detail if VCI a concern*

Data Item	Value	Comments
Access to understructure	Yes No	Location: *Sketch location(s)on attached map and document with photos*
<u>LOCATION AND QUANTITY OF VERMICULITE</u>		
VCI in attic	Yes No	
2. VCI in above attic *Finished attics only*	Yes No NA	
3. VCI under floor *Finished attics only*	Yes No NA	
VCI in kneewalls	Yes No NA	*Illustrate on Section Detail and document with photos*
Is VCI exposed?	Yes No NA	*Illustrate on Section Detail and document with photos*
4. Depth of VCI in attic	________ inches	
5. Square footage of area with VCI	________ square feet	
6. Estimated quantity of VCI to remove	________ cubic yards	
7. Other insulation in attic	Yes No	Type: Fiberglass Cellulose Other: ___________
Other insulation present in kneewalls?	Yes No NA	*Type: Fiberglass* *Cellulose* *Other: ___________* *Illustrate on Section Detail and document with photos*
8. Insulation in contact with VCI or in same space?	Yes No NA	
Depth of other insulation in attic	________ inches	
9. Estimated quantity of other insulation to remove	________ cubic yards NA	Calculations:

	Data Item	Value	Comments
10.	VCI in interior walls	Yes No Unknown	Wall Thickness: Wall Height:
11.	VCI in exterior walls	Yes No Unknown	Wall Thickness: Wall Height:
	Other insulation in walls	Yes No Unknown	Type: Fiberglass Cellulose Other: ___________ Wall Thickness: Wall Height:
	VCI present in other attics? (i.e., porches, additions, entryways)	Yes No Unknown	*Sketch location(s)on attached map and document with photos*
	Depth of VCI in other attic	_________ inches	
	Other insulation in other attic?	Yes No Unknown	Type: Fiberglass Cellulose Other: ___________
	Is VCI leaking into living space?	Yes No	Rooms: *Document with photos* *If VCI leaking into multiple levels, sketch floorplan identifying locations/room dimensions. Collect photos.*
	Is VCI visible in HVAC registers?	Yes No NA	*Sketch location(s)on attached map and document with photos*
12.	Contamination present in understructure?	Yes - VCI Yes - Vermiculite in soil No NA	Description: *Document with photos*
	If understructure contamination exists:	Obstructions present? Depth of VCI:_____ in Height:_____ ft Length: _____ ft Width:_____ ft	Yes No NA *Document with photos*
	Evidence of vermiculite	Yes No	If yes, describe condition:

Data Item	Value	Comments
used in building materials?		*Document with photos*
Evidence of vermiculite used in building materials?	Yes No	If yes, describe condition: *Document with photos*
Evidence of vermiculite used in building materials?	Yes No	If yes, describe condition: *Document with photos*
Best means of access to contaminated areas?	Present Access Enlarge Present Access Create New Access Through Roof Through Attic Floor Through Lower Level Ceiling Other ______________	Location: *Sketch location(s)on attached map and document with photos*
DUST SAMPLING		
13. Areas(s) where dust samples were not collected due to visible VCI *circle all that apply*	Basement Ground floor Second floor Attached garage Other_______________ None - No visible VCI in living space	
14. Outbuildings sampled?	Yes - exterior contamination present No - no exterior contamination No - VCI present in interior	

PHOTO LOG

ADDITIONAL INFORMATION

Appendix B

Sampling and Analysis Plan for Indoor Dust

SAMPLING AND ANALYSIS PLAN FOR INDOOR DUST

For Use at the Libby, Montana, Superfund Site

Revision 0

August 7, 2003

Prepared by:
U.S. Environmental Protection Agency, Region 8
999 18th Street, Suite 500
Denver, CO 80202

With Technical Assistance From:

CDM Federal Programs Corporation
1331 17th Street, Suite 1050
Denver, CO 80202

and

Syracuse Research Corporation
999 18th Street, Suite 1975
Denver, CO 80202

APPROVAL PAGE

This Sampling and Analysis Plan has been prepared by the U.S. Environmental Protection Agency, Region 8, with technical support from CDM Federal Programs Corporation and Syracuse Research Corporation. Study activities addressed in this Plan are approved without condition.

Program Approval
Jim Christiansen
USEPA Remedial Project Manager
Libby Asbestos Site

Date 8/6/03

Technical Approval
Mary Goldade
USEPA Regional Chemist

Date 8/7/03

DOCUMENT REVISION LOG

Revision	Date	Major Changes
0	08/07/03	--

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

AHERA	Asbestos Hazardous Emergency Response Act
CSS	Contaminant Screening Study
DQA	Data Quality Assessment
EDS	Energy Dispersive Spectroscopy
LA	Libby Amphibole
PE	Performance Evaluation
QA	Quality Assurance
QC	Quality Control
RI	Remedial Investigation
RPD	Relative Percent Difference
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
TEM	Transmission Electron Microscopy
USEPA	United States Environmental Protection Agency
VCI	Vermiculite-Containing Insulation

A. PROJECT MANAGEMENT

A4. PROJECT/TASK ORGANIZATION

The project for which this Sampling and Analysis Plan (SAP) has been prepared is being planned and performed by the U.S. Environmental Protection Agency (USEPA) Region 8. The following individuals are the USEPA project personnel with overall responsibility for the design and conduct of the project:

- Jim Christiansen, USEPA Remedial Project Manager (RPM), oversees all remedial activities at the Libby Operable Unit 4 site and is the primary data user and decision-maker at the site.

- Aubrey Miller, USEPA Regional Toxicologist, serves as the technical lead for all scientific and medical aspects of the project related to estimation of human health risk from asbestos exposure.

- Mary Goldade, USEPA Regional Chemist, serves as the technical lead for all aspects of the project related to the collection and analysis of environmental samples for asbestos content.

Responsibility for implementation of the SAP specified in this document has been assigned to the U.S. Department of Transportation Volpe Center and to CDM Federal Programs Corporation. The Volpe Technical Lead will have overall responsibility for coordinating the project and ensuring compliance with this SAP.

A5. PROBLEM DEFINITION and BACKGROUND

Libby, Montana, is a community located near an open pit vermiculite mine which began limited operations in the 1920's and was operated on a larger scale by the W. R Grace Company from approximately 1963 to 1990. Studies at the site have revealed that the vermiculite from the mine contains amphibole-type asbestos. This is referred to in this project as Libby Amphibole (LA) asbestos. Although the mine has ceased operations, concern exists that residual mine-related materials could be serving as on-going sources of LA release to indoor and outdoor air in Libby, and that these exposures could be of health concern to current and future residents and workers in the area.

One potential source of LA exposure in area homes and workplaces is indoor dust. Asbestos in indoor dust may become airborne as a result of disturbances by human activities, leading to the potential for inhalation of asbestos fibers by residents or workers. It is important to note that indoor dust is not a primary source of LA, but may become contaminated with LA from other sources, including past or present releases from indoor vermiculite insulation, transport of outdoor soil that contains LA, historic transport of LA-containing dust from the mine on workers clothing, etc. Thus, once the pathway from the primary source to dust is interrupted, an eventual decrease in LA levels in indoor dust will occur. However, if the dust has become substantially contaminated with asbestos, human exposure may continue to occur for some time at levels of potential concern even after the primary source(s) is(are) controlled. It is for this reason that a method is needed to evaluate the level of asbestos in indoor dust and a guideline is needed for determining when the asbestos level is high enough to warrant a direct remediation of the dust.

This document provides a detailed description of the program that will be used for collection, analysis and interpretation of asbestos levels in indoor dust at Libby, Montana.

A6. PROJECT/TASK DESCRIPTION

The basic tasks required to develop a SAP that will support risk management decision-making with regard to indoor dust are:

1. Establish a standard method for the selection of indoor dust sampling locations
2. Establish a standard method for the collection of indoor dust samples
3. Establish a standard method for the analysis of indoor dust samples
4. Establish a quality assurance program to assess the reliability of the dust data
5. Establish a standard method for interpreting the results and deciding when dust remediation is needed

A7. QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

EPA has developed a seven-step Data Quality Objectives (DQO) procedure that is designed to ensure that sampling and analysis plans are carefully thought out and that the plan will be adequate to meet the basic objectives of the program. Application of this seven step procedure to the development of the SAP for indoor dust is presented below.

Step 1. State the Problem

As discussed above, EPA's plan for addressing human exposure to asbestos in Libby focuses on identifying and removing LA sources such as vermiculite insulation and contaminated outdoor soils. However, in some locations, indoor dust may have become sufficiently contaminated that active remediation of dust is needed to protect human health. A standard method for dust collection and asbestos analysis has been established (ASTM D5755-95), but some project-specific clarifications and modifications are needed to ensure the data collected by this method are adequate to identify and quantify LA, and to ensure consistency in approach between laboratories. In addition, this method needs to be incorporated into a larger sampling and analysis plan that provides a consistent and logical basis for deciding where to sample and how to interpret the results.

Step 2. Identify the Decision

The basic decision to be made is whether indoor dust at a particular location contains LA levels that are high enough that active remediation by EPA of contaminated dust is needed (in addition to direct source control). Although other types of asbestos may occur in some dust samples, all decisions regarding the need for active dust remediation by EPA will be based on LA levels.

Step 3. Identify Inputs to the Decision

Inputs to the decision include reliable data on the concentration of LA in dust. This information, in turn, is obtained by the collection and analysis of dust samples from homes and commercial properties in Libby. Analysis of dust for asbestos is achieved by microscopic examination of the dust sample in order to estimate the number of LA structures present in the sample. Results are generally expressed a structures per cm^2 of surface area sampled.

Step 4. Define the Study Boundaries

The spatial boundary of the project includes all homes and workplaces in Libby that may have been impacted by past or ongoing asbestos contamination. Because it is possible that, within any particular building, dust contamination with LA may vary between levels (floors), each level of a residence or building will be evaluated as a separate unit. Note, however, that because dust is not a primary but a secondary source, dust sampling is not needed in all locations, but only in locations where there is some reason to suspect that contamination of dust may have occurred by one or more LA release or transport mechanisms.

Step 5. Develop a Decision Rule

At present, there is no standard method for establishing a quantitative relationship between the level of LA in dust and the resultant level of health risk to humans. However, screening-level risk calculations indicate that a concentration of approximately 5,000 LA structures per cm^2 may be associated with risks that exceed EPA's usual guidelines and which could pose an unacceptable residual risk to residents (USEPA 2003). On this basis, the decision rule is:

> *If the average concentration of LA in indoor dust on a particular level (floor) of a particular residence or building is greater than 5,000 LA structures per cm^2, EPA will perform active remediation of that contaminated dust.*

If the average indoor dust concentration does not exceed 5,000 LA s/cm^2, active dust remediation will not be taken.

Step 6. Specify Limits on Decision Errors

Because of statistical variation when a dust sample is analyzed, the reported concentration in a sample may not equal the true concentration in that sample. In some cases, the estimate will be too high, while in other cases the estimate will be too low. Because of this statistical variation in analytical results, two types of decision error may occur:

> Type I Error: The true concentration of LA in dust is lower than 5000 s/cm^2, but the estimated value is above 5000 s/cm^2, and active dust remediation is undertaken even though it is not needed.
>
> Type II Error: The true concentration of LA in dust is higher than 5000 s/cm^2, but the estimated value is less than 5000 s/cm^2, and no active dust remediation is undertaken.

Both types of error are of concern to EPA. Occurrence of a Type II error means that humans may be exposed to LA at a level of potential concern, and a Type I error means that time and money resources have been expended that might have been better spent elsewhere.

Figure 1 shows the probability that a decision error will occur, plotted as a function of the true concentration of LA at a location. Because the probability of a decision error depends on the sensitivity of the analysis, three different curves are shown, corresponding to an analytical sensitivity of 500, 1,000, or 2,500 s/cm^2. When the true concentration is less than 5,000 s/cm^2, only Type I errors can occur (the true concentration is less than 5,000 s/cm^2, but the measured value may be above 5,000 s/cm^2). Conversely, when the true concentration is above 5,000 s/cm^2, only a Type II error can occur (the true concentration is above 5,000 s/cm^2, but the measured value may be below 5,000 s/cm^2). As seen, as the sensitivity increases (becomes poorer), the chances of both a Type I and a Type II error increase.

Choosing the maximum acceptable Type I and Type II error rate is a risk management decision. At this site, the error rate goals are as follows:

Error Type	Error Rate Goal
Type I	Less than 10% at a true concentration of 2,500 s/cm^2
Type II	Less than 10% at a true concentration of 10,000 s/cm^2

These error rates are chosen based on the recognition that the decision rule for active dust cleanup by EPA (5,000 LA s/cm^2) is based on a number of assumptions, and hence it is inappropriate to think of the rule as if there were a clear and sharp distinction between values above and below 5,000 s/cm^2. Rather, there is a gradient of concern as a function of increasing dust contamination, and values of 4,000 s/cm^2 (which would not trigger EPA intervention) are only slightly less of concern than values of 6,000 s/cm^2 (which would trigger EPA intervention).

In addition, it is important to recognize that if a Type II error occurs, the exposure that results is not expected to be long-lasting, but to diminish over time (because all known primary sources will have been removed or encapsulated). In this regard, EPA will provide HEPA vacuums to all residents in Libby, so routine cleaning by residents will, over time, have nearly the same effect on dust as active remediation by EPA. Finally, if a Type I error occurs, the funds and resources expended are not actually "wasted", since the presence of asbestos in dust does pose a hazard regardless of level, and removal of dust at locations that are actually somewhat lower than 5,000 s/cm^2 will only decrease risk and hasten the achievement of overall goals.

As seen by inspection of Figure 1, these target error rates can be achieved if the sensitivity of each dust analysis is 1,000 s/cm^2 or less. This sensitivity can be achieved most easily by adjusting the number of grid openings counted, or by using ashing to reduce the amount of non-asbestos debris in the sample (and hence reducing the dilution factor that must be used to avoid overloading).

Step 7. Optimize the Design for Obtaining Results

The SAP for dust may be revised and refined as additional information is collected during the project.

B. MEASUREMENT/DATA ACQUISITION

B1. SAMPLING PROCESS DESIGN

Indoor dust samples will be collected and analyzed in accord with this SAP under several different but inter-related programs at the site, including the following:

1. CSS. The Contaminant Screening Study (CSS) is an interim step in the performance of a full Remedial Investigation (RI) as the site. The CSS was initiated in May 2002 with the goal of assigning every property in Libby into one of three categories: remediation required, no remediation required, or additional information required. The CSS investigation uses a combination of visual inspections, verbal interviews, and soil sampling to screen each property in the study area for the presence or absence of potential sources of LA.

2. Pre-Design Investigations. Pre-design investigations will be performed at all homes that have been identified during the CSS as requiring one or more types of remediation. Pre-design inspection teams will collect any additional samples (potentially including indoor dust samples) required to determine specific remediation needs.

3. RI sampling. For homes that went through the CSS and were identified as requiring further evaluation (i.e., there was no clear trigger for cleanup, but there was some

indicator that dust may be contaminated), EPA will revisit the property, primarily to take dust samples.

As noted above, because indoor dust is a secondary source, sample collection and analysis is not required at all locations, but only when there is an indication that dust contamination might be of concern. The triggers for collection of a dust sample under each program vary, and are described in the project plan for each program (CDM 2002, 2003a, 2003b). Some possible examples of triggers for dust collection include the following:

- The property is located near a known historic or current source of LA or vermiculite release
- LA and/or vermiculite were detected above levels of concern in soil samples from the property
- The building previously had interior vermiculite-containing insulation (VCI), currently has non-exposed vermiculite, or the presence of VCI (past and/or present) cannot be determined
- The property is or was occupied by a worker at the mine
- The property is or was occupied by a person with asbestos-related lung disease

Specific triggers for dust collection and analysis may be revised as data collection proceeds and new information becomes available.

When a dust sample is collected, the indoor sampling locations at each such property will be selected in the field based on where contaminated dust is most likely to be found. All dust samples will be a composite, generally from three sub-locations, each 100 square centimeter (cm^2) in area. The number of samples and sample locations are determined as follows:

- Two dust samples (each a composite of three 100-cm^2 templates) will be collected on each level of the living space (i.e., finished basement, ground floor, 2nd floor). One composite sample from each floor will be collected from accessible horizontal surfaces (i.e., windowsill, shelving, cabinets, etc.). The second composite sample on each floor will be collected from high-traffic walkways (including solid surfaces and rugs or carpets), focusing on the most probable walkway for tracking contamination into that level of the building.

- Unfinished attics, basements, and attached garages will not be considered part of the living space and will be characterized separately. One three-template composite sample will be collected from high-traffic walkways and horizontal surfaces inside attics, unfinished basements, and attached garages.

- Outbuildings (i.e., shed, detached garages) will be sampled only if soil is observed to be contaminated, if the outbuilding contains, or is known to have contained, VCI, or if there are other indications of secondary sources (residents worked at the mine or have asbestos-related disease, etc.). One three-template composite sample will be collected from the outbuilding entryway and horizontal surfaces.

Note that whenever exposed VCI is visible at a sampling location (i.e., a specific level of a specific building), a dust sample will not be collected from that location. This is because the presence of visible exposed VCI is taken as *prima fascia* evidence that active remediation of the VCI and any associated dust will be required. Therefore, collection and analysis of a dust sample is not needed.

B2. SAMPLING METHODS REQUIREMENTS

Dust sampling is performed in basic accord with the American Society for Testing Materials (ASTM) Method D5755-95 (ASTM 1995), except as noted below. In brief, dust is collected using a microvacuum that consists of a battery-operated low volume sampling pump connected to a 25-millimeter (mm) vacuum dust sampler cassette equipped with a mixed cellulose ester (MCE) filter with a pore size of 0.45 um.

Typically, three sub-areas, each 100 cm^2 in area, will be sampled. Each sub-area will be delineated using a template. At each sub-area, dust will be drawn into the cassette by activating the pump and passing the nozzle along the surface for 2 minutes in a manner sufficient to vacuum up the settled dust, as detailed in ASTM D5755-95. After dust from the last sub-area is collected, the cassette will be capped, sealed, and labeled as described in Section B3 (below).

Pump calibration will be performed by using a primary standard calibration device (e.g. Dry-Cal) with a 25 mm diameter 0.45 micron MCE filtered cassette inline before sample collection. The flow-rate of the low-volume sampling pump will be 2 liters per minute (approximate air velocity of 100 (± 10) cm/sec based on the flow rate and the 6.35 mm tubing diameter) throughout the sample period.

B3. SAMPLE DOCUMENTATION, HANDLING AND CUSTODY REQUIREMENT

Field Log Book

Each sampling team will maintain a field log book in accord with CDM SOP 4-1 (Field Logbook Content and Control). Typically the following information is recorded for each location visited:

- Names of team members
- Location (address) of sample collection site
- Date and time of sample collection
- Number and location of samples collected
- Location(s) of any visible VCI (dust samples will not be collected at these locations)
- Any deviations from standard procedures
- Any special circumstances that influenced sample collection

Field Data Sheets

Detailed information on each dust sample collected will be entered onto a field data sheet in accord with SOP CDM-Libby-03. Field data sheets to be used for dust are presented in Appendix A.

Sample Numbering System

All dust samples collected during the CSS and RI will be assigned a sample number in accord with the numbering system defined in the project-specific plan. These sample numbers may be assigned in any order that is convenient for field supervisors and sampling crews. In order to minimize the chance of error in number assignment, pre-printed sheets of adhesive labels with sequential sample numbers will be prepared and provided to field crews. Each sheet will have four identical labels for each sample number. Once a sample is collected, one adhesive label will be attached to the sample cassette, one to the zip-lock bag used to contain the cassette, one to the appropriate field data sheet, and one in placed in the field log book.

Sample Handling and Custody Requirements

Once the dust sample has been collected and sealed as described in ASTM D5755-95 (with modifications described above), a custody seal will be affixed to the cassette. The cassette will be placed into a separate zip-lock baggie. Custody of all indoor dust samples will be relinquished to the sample coordinator for hand-delivery to the onsite laboratory or shipment to an offsite laboratory. If dust samples are to be shipped, they will be packaged and shipped in accordance with CDM SOP 2-1, Packaging and Shipping of Environmental Samples (CDM 2002).

The chain-of-custody for all samples will be prepared in accordance with CDM SOP 1-2. All required paper work, including sample container labels, chain-of-custody forms, custody seals and shipping forms will be fully completed in ink (or printed from a computer) prior to shipping of the samples to the laboratory. All corrections to the chain-of-custody record will be initialed and dated by the person making the corrections. Each chain-of-custody form will include signatures of the appropriate individuals indicated on the form. The originals will accompany the samples to the laboratory, and copies documenting each custody change will be recorded and kept on file.

Upon receipt at the laboratory, the samples will be given to the laboratory sample custodian. The shipping container(s) will be opened and the contents inspected. Chain-of custody forms will be reviewed for completeness, and samples will be logged and assigned a unique laboratory sample number. Any discrepancies or abnormalities in samples will be noted and the sample coordinator for the project will be promptly notified.

All sample cassettes must be maintained by the laboratory under chain-of-custody until otherwise instructed by the laboratory coordinator.

Record Keeping

The Volpe technical lead will maintain all original hard copy and electronic data generated during the project, including log books, field data sheets, analytical data packages, and other relevant reports. One copy of each chain-of-custody will be kept by the sample coordinator. A complete copy of all relevant records will be provided to EPA.

B4. ANALYTICAL METHODS REQUIREMENTS

All dust samples will be analyzed for asbestos content using transmission electron microscopy (TEM) coupled with energy dispersive spectroscopy (EDS). Samples will be prepared for TEM analysis using an indirect preparation, as described in ASTM D5755-95, with project-specific modification as described in SOP SRC-LIBBY-05.

B4.1 Sample Preparation

Basic Procedure

The sample cassette is opened and the contents are rinsed out and resuspended in 100 mL of a particle free-mixture of water and ethanol (50:50 by volume). A fraction of this resuspension fluid (up to a maximum of 50 mL) is then applied to a secondary MCE filter such that the total dust loading on the secondary filter does not exceed approximately 20-25%. A fraction of this secondary filter is then used for preparation of two or more TEM grids, as detailed in ASTM D5755-95.

Check of Sensitivity

The sensitivity of an analysis is given by the following equation:

$$\text{Sensitivity (s/cm}^2) = \text{EFA} / (\text{GO} \cdot \text{AGO} \cdot \text{AREA} \cdot \text{F})$$

where:

EFA = effective area (mm^2) of the secondary filter
GO = Number of grid openings counted
AGO = Area of a grid opening (mm^2)
AREA = Area from which the dust sample was collected (cm^2)
F = Fraction of the original sample applied to the secondary filter

As discussed in the DQO section, a minimum sensitivity of 1,000 s/cm^2 is required in order to achieve the specified decision error tolerances. It is expected that for most dust samples, this sensitivity can be achieved by analysis of 10 grid openings. For example, given typical analytical parameters (EFA = 1295 mm^2, GO= 10, AGO = 0.01 mm^2, AREA = 300 cm^2, F = 0.1), the sensitivity will be 432 s/cm^2. If the dust content of the sample is so high that a higher dilution is required (e.g., $F < 0.05$), then a sensitivity of 1,000 s/cm^2 cannot be obtained using 10 grid openings, but can be achieved by increasing the number of grid openings to some number between 11 and 20. In this case, the sample should be analyzed by counting the number of grid openings needed to achieve the target sensitivity. If a sensitivity of 1,000 s/cm^2 cannot be achieved by counting up to 20 grid openings, an ashing step is required in order to reduce debris loading (thereby allowing a larger value of F), as described below.

If the necessary sensitivity cannot be achieved even after ashing, then the laboratory should complete a laboratory modification form to summarize the issues associated with that sample.

Ashing (If Needed)

Based on the results of the first analysis, the laboratory should estimate the volume of resuspension fluid needed to achieve the detection limit required and apply that volume to a new secondary filter. The entire filter should be ashed and the residue re-suspended and filtered as described in EPA 540/2-90/005a (USEPA 1990), as modified in SOP SRC-LIBBY-02 (Revision 1).

B4.2 Sample Analysis

All dust samples will be analyzed by TEM as described in ASTM D5755-95, except for project-specific modifications described in SOP SRC-LIBBY-05.

Mineral Type Classification

Each countable asbestos structure shall be assigned to one of three broad classes of asbestos mineral class as follows:

Mineral Class	Description
Libby Amphibole (LA)	Any amphibole asbestos similar to that observed in ores obtained from the mine in Libby. This includes mainly actinolite, tremolite, richterite, and winchite, as well as magnesio-arfedsonite and ferro-edenite.
Other Amphibole (OA)	Other types of amphibole asbestos, including amosite, anthophyllite, and crocidolite. These forms of asbestos are not thought to be related to the mine in Libby.
Chrysotile (C)	Serpentine asbestos. This form of asbestos is the most common type in building materials, and is not thought to be related to the mine in Libby.

This assignment shall be based on a combination of particle morphology, electron diffraction pattern, and EDS spectrum. A discussion of the EDS spectrum associated with LA fibers is presented in USGS (2002).

Stopping Rules

All samples shall be analyzed by examination of a minimum of 4 grid openings. After a minimum of 4 grid openings, the count may be stopped when one of the following conditions is satisfied:

- A sensitivity of less than 1,000 s/cm^2 has been achieved
- A total of 20 grid openings have been examined
- A total of 50 countable LA structures have been recorded

All data shall be recorded in an electronic data sheet as provided in Appendix B. The sensitivity may be calculated using the electronic spreadsheet provided in Appendix C.

B5. QUALITY CONTROL

Quality Control (QC) is a component of the SAP, and consists of the collection of data that allow a quantitative evaluation of the accuracy and precision of the field data collected during the project. QC samples that will be collected during this project include the following types of samples.

Lot Blanks

Whenever a new lot of filter cassettes are received from the supplier, one cassette from the lot will be selected at random and submitted for analysis to ensure that no significant asbestos contamination exists on the filters from that lot. These will be supplied to the laboratory with a request for analysis using a DIRECT PREPARATION, since this increases the sensitivity and provides maximum likelihood of detecting any contamination on the filters. Results for lot blanks shall be reported only as fiber loading (s/mm^2), since there is no applicable value for the area vacuumed.

No samples shall be collected in cassettes that have not been subject to a lot blank check. All filters in the lot will be rejected if one or more asbestos structures (any type) are observed.

To date, no asbestos fiber has been observed on any lot blank.

Field Blanks

Field blanks will be collected at a frequency of 1 per 50 field samples (2 percent). This frequency is used in place of the more customary rate of 5% because of experience gained at the

This assignment shall be based on a combination of particle morphology, electron diffraction pattern, and EDS spectrum. A discussion of the EDS spectrum associated with LA fibers is presented in USGS (2002).

Stopping Rules

All samples shall be analyzed by examination of a minimum of 5 grid openings. After a minimum of 4 grid openings, the count may be stopped when one of the following conditions is satisfied:

- A sensitivity of less than 1,000 s/cm^2 has been achieved
- A total of 20 grid openings have been examined
- A total of 50 countable LA structures have been recorded

All data shall be recorded in an electronic data sheet as provided in Appendix B. The sensitivity may be calculated using the electronic spreadsheet provided in Appendix C.

B5. QUALITY CONTROL

Quality Control (QC) is a component of the SAP, and consists of the collection of data that allow a quantitative evaluation of the accuracy and precision of the field data collected during the project. QC samples that will be collected during this project include the following types of samples.

Lot Blanks

Whenever a new lot of filter cassettes are received from the supplier, one cassette from the lot will be selected at random and submitted for analysis to ensure that no significant asbestos contamination exists on the filters from that lot. These will be supplied to the laboratory with a request for analysis using a DIRECT PREPARATION, since this increases the sensitivity and provides maximum likelihood of detecting any contamination on the filters. Results for lot blanks shall be reported only as fiber loading (s/mm^2), since there is no applicable value for the area vacuumed.

No samples shall be collected in cassettes that have not been subject to a lot blank check. All filters in the lot will be rejected if one or more asbestos structures (any type) are observed.

To date, no asbestos fiber has been observed on any lot blank.

Field Blanks

Field blanks will be collected at a frequency of 1 per 50 field samples (2 percent). This frequency is used in place of the more customary rate of 5% because of experience gained at the site which indicates that the occurrence rate of LA fibers on field blanks is very low, as shown below:

Parameter	ISO	AHERA
Total number	1738 (100%)	1534 (100%)
Number with reported asbestos	45 (2.6%)	2 (0.13%)
Number with reported LA	7 (0.4%)	1 (0.07%)

Based on database download on July 31, 2003.

Field blanks are prepared by opening the end of a microvacuum cartridge at a sampling location and exposing to air for 5-30 seconds. The end is then closed and the sample submitted for analysis. Dust field blanks are used to determine if airborne asbestos is causing detection on dust samples and/or if cross-contamination is occurring during sampling procedures.

Like lot blanks, field blanks will be supplied to the laboratory with a request for analysis using a DIRECT PREPARATION, since this increases the sensitivity and provides maximum likelihood of detecting any contamination on the filters. Results for lot blanks shall be reported only as fiber loading (s/mm^2), since there is no applicable value for the area vacuumed.

If one or more LA structures is detected on a field blank, that result should be promptly communicated to the EPA regional chemist or her delegate. These individuals will evaluate the data, confer with project managers as needed, and decide what corrective actions may be required. Specific decisions may vary, depending on the nature of the samples in the same analytical group and the intended use of the data.

Laboratory-Based QC Samples

Each laboratory will prepare and analyze six different types of QC sample in accord with the frequency specified in Modification LB-00029. Responses for samples that are outside expected limits are also specified in Modification LB-00029.

B6. INSTRUMENT CALIBRATION AND FREQUENCY

All instruments shall be calibrated at a frequency in accord with NVLAP requirements. A log shall be maintained for each instrument that documents all calibration and maintenance activities.

B7. DATA MANAGEMENT

Data generated during this project will be managed using the basic methods and procedures established for this project. In brief, all data are entered into a project-specific database by appropriately trained data entry staff. The data entered into the database includes all relevant field information regarding each environmental samples collected, as recorded on the Field data Sheets and in the field log book, as well as the analytical results provided by the laboratory. All data entries are reviewed and evaluated for accuracy by the data entry manager or his/her delegate. All original data records (both hard copy and electronic) will be cataloged and stored in their original form by the Volpe Technical Lead until otherwise directed by the EPA RPM.

C. ASSESSMENT AND OVERSIGHT

C1. ASSESSMENTS AND RESPONSE ACTIONS

Quality Assurance assessments performed during this project will include the following:

1) Oversight of field sampling activities
2) Oversight of sample handling and chain of custody procedures
3) Laboratory inspections

The following individuals or their delegates are authorized to perform any of the assessments above:

- EPA RPM
- EPA Regional Chemist
- Volpe Project Manager

Assessment of field sampling and other project activities may occur at any time and without prior notification. Each of the individuals above has authority to specify any appropriate response action that may be deemed necessary to resolve problems detected during the assessments. This could range from a simple review of approved SOPs with field staff to address minor problems, to requiring submission of corrective action reports and follow-up audits, up to a temporary stop work order to provide time for senior project managers to address more significant issues.

C2. REPORTS TO MANAGEMENT

Reports to management will be prepared and provided as described in each project-specific project plan. The Volpe Project Manager will provide the EPA RPM and the EPA technical leads and/or their delegates with regular verbal reports on project status.

D. DATA VALIDATION AND USABILITY

Data generated in accord with the guidance set forth in this SAP will be evaluated and/or reviewed for level of quality and usability as described in this section.

D1. DATA REVIEW, VERIFICATION, VALIDATION, and EVALUATION

Data Verification

Data verification is a consistent and systematic process that determines whether the data have been collected in accordance to the specifications as listed in the approved SAP, its appendices/attachments or approved modifications. This process is independent of data validation, and is conducted at various levels both internal and external to the data generator (laboratory).

Data Validation/Evaluation

Data validation is generally defined as an evaluation of the technical usability of the verified data with respect to planned objectives. Data validation is performed external to the data generator (laboratory) by applying a defined set of performance criteria to the body of data in the evaluation process. This may include checks of some or all of the calculations in the data set, and reconstruction of some or all final reported data from initial laboratory data (e.g., photographs, EDS spectra). It is in the data validation process that data qualifiers for each verified datum are evaluated and assigned. It extends beyond the analytical method or contractual compliance to protocols to address the overall technical usability of the generated data. EPA does not currently offer guidance on the validation of asbestos sample analysis. Therefore, project-specific review criteria have been developed and continue to be refined. These project-specific review criteria are referred as “Data Evaluation” to avoid confusion if data validation procedures are defined by EPA in the future. Further, data evaluation is performed as a component to the overall Data Quality Assessment (DQA) process which will be employed as a project-specific review on overall precision and accuracy of site samples.

D2. VERIFICATION AND EVALUATION METHODS

Data Verification

Data verification will include a review of the findings of all QA assessment activities (see Section C), including assessments of field collection procedures, sample labeling methods, chain-of-custody procedures, and all assessments of analytical data collection, recording and reporting. If any deviations are identified, the potential impact of those deviations on the reliability of the data will be assessed, and that information will be provided to the EPA RPM, the EPA technical leads, and the Volpe project manager.

Data verification for field samples will be performed by ensuring that each sample is accompanied by a complete chain of custody record, a complete field data sheet, a properly completed laboratory data sheet, and electronic data are properly imported into the project database. Any sample that lacks one or more of the required sets of documentation will be excluded unless the missing sample identification and documentation can reliably be obtained. In addition, the comments sections of the field data sheet and electronic laboratory data deliverable for each sample will be reviewed to determine if there are any notations which indicate that the sample may not be reliable. Any sample with a notation which indicates that the result may not be reliable will be considered unreliable unless a subsequent review determines that the datum is reliable. Data points determined to be unreliable or invalid will be permanently flagged with an "R" qualifier in the project database and excluded from subsequent data analyses, summaries, and reports. Documentation for the justification for the "R" qualifier as well as any other qualification assignments will be placed in the permanent project file.

Data Evaluation

The data evaluation process or Data Quality Assessment consists of two parts. First, a subset of data packages are reviewed against a data package checklist to determine if the raw data package is complete. The first 3-5 data packages prepared by each analytical laboratory will be reviewed. Subsequent data package reviews will be performed on a tri-monthly basis where data packages are randomly selected for each analytical laboratory.

The second part is a Data Quality Assessment (DQA) review. The DQA review process employs as a project-specific evaluation of overall precision and accuracy of site quality control (QC) samples. This DQA will be performed on a regular intervals to determine is QC samples such as blanks, duplicates, and reference samples/performance evaluation samples are within project-specific limits for precision and accuracy. These quantitative or qualitative limits of acceptability defined for precision and accuracy are discussed below.

Precision: Precision is defined as the agreement between a set of replicate measurements without assumption or knowledge of the true value. Agreement is often expressed as the relative percent difference (RPD) for duplicate measurements or standard deviation for larger numbers of replicates. Data on precision are obtained by analyzing duplicate or replicate samples.

Accuracy: Accuracy is a measure of the closeness of a sample analysis result to the "true" value. The accuracy of an analytical method is generally assessed by inserting a series of blind "performance evaluation" (PE) samples into the laboratory sample stream, where the "true" concentration of analyte in each PE sample is known. However, PE samples are not available for asbestos in dust, so accuracy will be evaluated primarily by an evaluation of agreement between repeat analyses, both within a laboratory and between laboratories.

Data quality assignment recommendations resulting from the DQA review will be documented in a technical memorandum and qualifications applied to electronic data (database) accordingly.

D3. RECONCILIATION WITH DQOs

The Data Quality Assessment reports will be reviewed by the EPA Regional Chemist and the Volpe Project manager to determine its usability in accordance with EPA guidance on assessing data useability for risk assessment (USEPA 1992), and to determine whether the data are adequate to meet the project objectives.

E. REFERENCES

ASTM. 1995. Standard Test Method for Microvacuum Sampling and Indirect Analysis of Dust by Transmission Electron Microscopy for Asbestos Structure Number Concentrations. Designation D5755-95. October.

CDM. 2002. Final Sampling and Analysis Plan, Remedial Investigation Contaminant Screening Study. April.

CDM. 2003a. Final Sampling and Analysis Plan, Remedial Investigation, Libby Asbestos Site, Operable Unit 4. May 19, 2003

CDM. 2003b. Pre-Design Sampling and Analysis Plan. *Document in preparation*.

NIST. 1994. Airborne Asbestos Method: Standard Test Method for Verified Analysis of Asbestos by Transmission Electron Microscopy - Version 2.0. SOP prepared by S. Turner and E.B. Steel, U.S. Department of Commerce, National Institute of Standards and Technology. NIST IR 5351. March 1994.

USEPA. 1986. Airborne Asbestos Health Assessment Update. EPA/8-84/003F. June 1986.

USEPA. 1987. Asbestos-Containing Materials in Schools; Final Rule and Notice. Federal Register 40 CFR Part 763, 52(210):41826-41905. October 30, 1987.

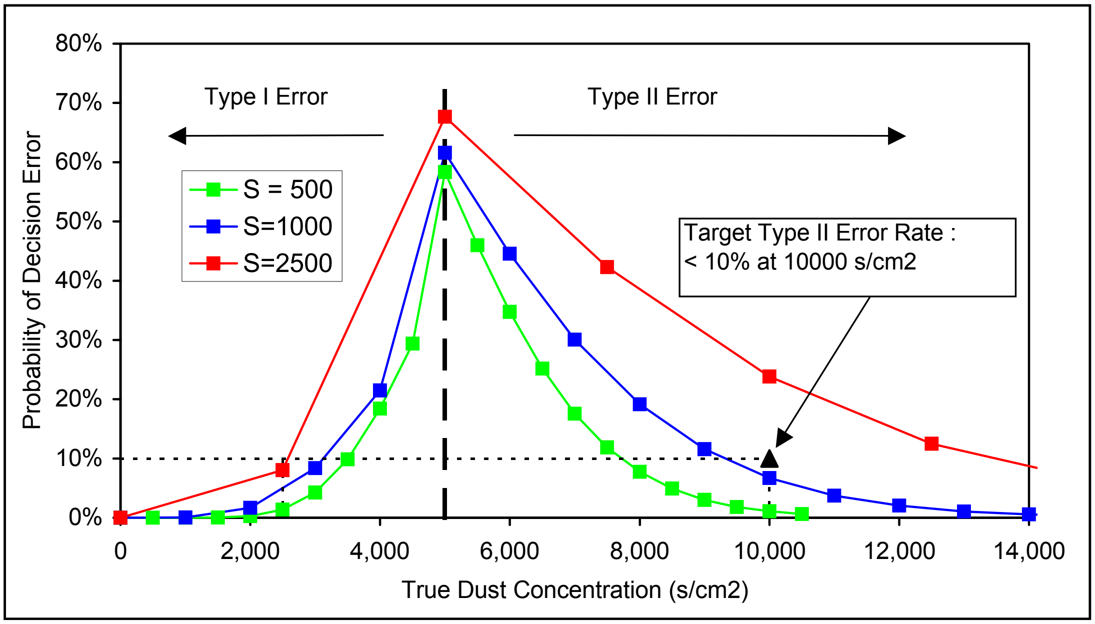
USEPA. 1990. Superfund Method for the Determination of Asbestos in Ambient Air. Part 1: Method. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. EPA/540/2-90/005a. May 1990.

USEPA. 1992. Guidance for Data Useability for Risk Assessment (Part A). U.S. Environmental Protection Agency, Office of Emergency and Remedial Response. Publication 9285.7-09A. April, 1992.

USEPA. 2003. Screening Level Estimates of Exposure and Risk from Libby Amphibole in Air, Dust, and Soil. Report prepared by USEPA Region 8 with technical assistance from Syracuse Research Corporation.

USGS. 2002. Guide to Analysis of Soil Samples from Libby, Montana for Asbestos Content by Scanning Electron Microscope and Energy Dispersive Spectroscopy. U.S. Geological Survey Administrative Report prepared by Amy Bern, Greg Meeker, and Isabelle Brownfield. October 17, 2002.

FIGURE 1. PROBABILITY OF DECISION ERRORS



EXPLANATION. The estimated concentration of asbestos in a dust sample (s/cm2) is calculated as N*S, where N = number of structures observed and S = sensitivity. The sensitivity (s/cm2) is a function of the area of the secondary filter, the area of a grid opening, the number of grid openings counted, the area vacuumed, and any dilution factors used to prepare the filter. Because of statistical variation, there is uncertainty in any observed value of N. This uncertainty is described by the Poisson distribution, which predicts the chances of observing a count of N if the true concentration is equal to some specified value (e.g., 5000 s/cm2). The three curves above are derived using the Poisson distribution to calculate the statistical chances of observing a count that will result in an decision error, assuming a decision rule of 5,000 s/cm2.

APPENDIX A

FIELD DATA SHEETS FOR DUST

Sheet No: D-___

LIBBY MONTANA SITE INVESTIGATION
FIELD SAMPLE DATA SHEET FOR
DUST

Address or Location ID:____
GPS (if no address available): Northing_______________ Easting________________
Owner:____
Land Use Category: Residential School Commercial Mining Other (___________)

Date:____
Sampling Team:__________________________________

Data Item	Cassette 1	Cassette 2	Cassette 3
Field ID Number			
Index ID			
Category (circle)	FS Blank	FS Blank	FS Blank
Location Description			
Sample area (cm^2)			
Flow Meter Type			
Flow Meter ID Number			
Pump ID Number			
Start-Time			
Start-Flow (L/min)			
Stop-Time			
Stop-Flow (L/min)			
Pump fault?	No Yes	No Yes	No Yes
Field Comments			

APPENDIX B

ELECTRONIC DATA SHEET FOR AIR AND DUST

Check with Volpe or SRC for latest spreadsheet version number

APPENDIX C

ELECTRONIC SPREADSHEET FOR CALCULATING SENSITIVITY

"Sensitivity Calc.xls"

Appendix C

AHERA Bulk Sampling Requirements